U.S. EPA Region 4 Air Toxics
Relative Risk Screening Analysis
September 27, 2002

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Background

The Clean Air Act (CAA) requires the Environmental Protection Agency to assess and address the impact of air toxics on human health and the environment in primarily a two-stage program (Clean Air Act of 1990, Section 112, National Emission Standards for Hazardous Air Pollutants). In the first stage of the program, technology based standards are applied to facilities to reduce emissions. In the second stage of the process, risk-based decision making is applied to identify areas of unacceptable risks and to institute risk reduction strategies to mitigate those risks. As part of this second phase program, EPA Region 4, in conjunction with state and local air program partners (the "Workgroup"), have performed a preliminary screening level analysis to begin to identify where in the Region air toxics may be having a relatively large adverse impact. The analysis presented in this paper has immediate utility for the initial roll-out of the unified air monitoring strategy being designed for the Region, the beginnings of which are being implemented in the latter half of 2002.

As part of the data quality objectives for this monitoring strategy, the workgroup thought it was important to identify locations where air toxics may pose a relatively higher health threat to a relatively higher number of people and to encourage at least some of the initial monitoring efforts to be directed towards those areas. Ultimately, the unified regional air toxics monitoring network will meet multiple monitoring objectives (e.g., rural monitoring, high risk/high population areas, medium size/medium risk areas, background evaluation, hot-spot analysis, trends, etc.). The tool described in this document primarily attempts to answer one of these monitoring objectives (i.e., high risk/high population) and is intended only as one of a number of possible information sources to aid decision makers as they allocate resources for monitoring and other analyses over the coming years. The results and methodology presented here will be refined as new information becomes available. This methodology has been favorably reviewed by EPA's Office of Air Quality Planning and Standards (OAQPS).

It should be noted that this analysis is a "20,000 foot view" of potential impacts of toxic air pollution in the Southeast. That is to say, the maps and matrix provided herein are of a screening level nature only and must not be construed to imply any cause-effect relationship between an actual case of disease or death and potential exposures. Also, while the data employed in this assessment are generally the most recent available, not all data sets are from the same year. Thus, the analyses provided in this document serve only as a starting point for highlighting areas with potential adverse air toxics impacts. Additional analysis (e.g., ground-truthing the data, identifying specific risk-drivers, evaluation of the impact of uncertainties in the datasets, etc.) must be considered when interpreting the results of this analysis for use in developing a unified long-term air toxics monitoring strategy.

Approach

To begin to understand the potential impact of air toxics on human health throughout the Southeast, the workgroup identified a number of metrics (called "indicator elements") that either relate directly to potential air toxics exposures or to potential health outcomes commonly associated with such exposures. Specifically, information on air toxics concentrations and exposures, population, and disease and mortality were combined, as described below, in Geologic Information System (GIS) and matrix formats to help rank the "relative risks" posed by air toxics at the county level for all of Region 4. The county level was selected because this is the lowest level of geographic scale common to all the indicator elements. Secondary, but relevant, information is also provided, but not quantified in the matrix (e.g., stagnation areas and non-attainment areas for selected chemicals governed by the National Ambient Air Quality Standards). For the data sets that were used in the quantitative relative ranking scheme, weighting factors were developed that, in the opinion of the Workgroup, represent an appropriate balance between the relevance of the data elements (i.e., their contribution to exposure and relative risk posed by air toxics) and the uncertainties associated therewith.

Synthesizing all this information to support decision-making on potential monitoring projects involved developing a weighted summation of the criteria for each county in the region (as outlined in Table 1, below). With the exceptions noted, the Workgroup used the most recent data available. The logic behind these factors and their weights is summarized below.

While the workgroup and OAQPS have reviewed this document for factual and calculational errors, any enhancements identified would be helpful for the next iteration of the document and should be referred to:

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Table 1. EPA Region 4 Air Toxics Relative Risk Ranking Scheme
Data Elements & Weighting Criteria

RISK PROJECTION BY COUNTY	***(TOTAL OF 50%)***
▸ 1996 National Air Toxics Assessment average individual cancer risk	10%
▸ 1996 National Air Toxics Assessment average individual noncancer hazard	10%
▸ 1996 National Air Toxics Assessment average Diesel PM exposure concentration	5%
▸ 1999 Risk Screening Environmental Indicator relative hazard ranking	25%
MORTALITY/MORBIDITY BY COUNTY	***(TOTAL OF 15%)***
▸ Total respiratory mortality using CDC age adjusted data	5%
▸ Total cardiovascular mortality using CDC age adjusted data	5%
▸ Total cancer morbidity using state cancer registry data	5%
POPULATION BY COUNTY	***(TOTAL OF 35%)***
▸ Total population density	15%
▸ Population density of people under 18 years of age	10%
▸ Population density of people 65 years of age and older	10%
TOTAL	***100%***

DATA USED IN THE MATRIX

Risk Projection by County

Available data sources that are directly related to an estimate of potential exposure and risk from air toxics were judged the most important criteria for this analysis and were given the most weight (50% of the total). Specifically, data on air toxics exposures and risks (or relative risk) were available from the National Air Toxics Assessment[1] (NATA) and the Toxics Release Inventory (TRI) Risk Screening Environmental Indicator[2] (RSEI) software. NATA provides *actual cancer risk estimates and non-cancer hazard estimates* for the average individual by county. The RSEI, on the other hand, provides *relative risk values* by county for air emissions reported to the TRI. These two sources of air exposure information complement each other since the NATA includes information on only a subset of hazardous air pollutants (33 chemicals, including stationary, mobile sources, and background), while the RSEI provides information only on relatively large fixed facility air emissions, but for a much larger universe of over 650 chemicals and chemical categories.

As noted above, NATA provides an actual estimated total cancer risk for an average individual in a county and an index for noncancer hazards for the average individual in a county. The RSEI, on the other hand, uses one weighted toxicity value to represent both cancer and noncancer toxicity. Using this combination toxicity value results in the RSEI providing an estimate of "relative" risk between any two entities (rather than actual risk or hazard for any one entity). In other words, NATA gives an estimate of cancer risk and noncancer hazard *for an individual for each county*; RSEI gives an estimate of relative (not absolute) risk *among counties*.

EPA's recent assessment of the health effects of diesel emissions indicates that these emissions are likely human carcinogens[3]. As such, the workgroup considered it imperative to also include some factor for diesel in this evaluation. NATA provides only an estimate of the average exposure concentration to diesel particulates, by county, and this information was included as a surrogate for risk. A more thorough description of these data sources used in this analysis is provided below.

<u>National-Scale Air Toxics Assessment</u>

The National-Scale Air Toxics Assessment, which is based on 1996 emissions data, provides results that are useful in understanding the quality of air and its possible effect on human health nationwide. The assessment addresses 33 air pollutants (a subset of 32 air toxics from the Clean Air Act's list of 188 air toxics plus diesel particulate matter), in a 4-step evaluation process:

- Estimating the release of these pollutants into the air from all known sources, *including vehicles*;
- Estimating the concentration of these compounds in the air following dispersion from the sources (at both the census tract and county level);
- Estimating the exposure of populations to ambient concentrations based on the estimated activities of cohorts of various types of individuals; and
- Estimating the risk of both cancer and noncancer health effects resulting from exposures.

It should be kept in mind that the NATA data are not a comprehensive look at current risks posed by air toxics because they:

- Consider only the 32 hazardous air pollutants considered most significant in urban environments and diesel PM, and are based on 1996 data only;
- Consider only inhalation exposure;
- Have relatively low resolution and may not accurately identify hot spots;
- May under-predict ambient airborne pollutant levels, especially for metals;
- Estimate typical, chronic exposure values, not extremes; and
- Do not consider the impact of indoor sources of air pollution.

<u>Risk Screening Environmental Indicator Relative Risk Ranking</u>

The RSEI is a computer model that permits screening level analysis of the relative (not absolute) impacts of toxic chemical releases to air and water. Only air releases are evaluated in this document. RSEI currently relies on the TRI database which catalogues, by facility, the releases of over 650 chemicals and chemical categories that are manufactured, processed, or otherwise used above certain amounts by various industries. The RSEI provides “relative risk values” among a variety of entities. For example, RSEI can provide the relative risk between two facilities or groups of facilities, between two counties, or between two states. For air releases of a chemical, the most useful result from RSEI is a “full model analysis” which incorporates toxicity, dispersion in the atmosphere, and number and type (e.g., child, adult) of affected population. Since population is already being included in this Region 4 analysis as a separate indicator element, another measure from RSEI that does not reflect population was selected to represent “relative hazard.” Specifically, the number of pounds of TRI releases reported to air, by county, in 1999 for which fate and transport data were sufficient to perform dispersion modeling and for which toxicity values were available were used to develop a “relative hazard” by county (rather than a “relative risk” as discussed above). Performing the analysis in this way allowed for a better matching of the NATA and RSEI results in the overall ranking matrix. Similar to NATA, the RSEI model addresses only chronic exposures. The current RSEI methodology attributes relative risk scores (or in this case, relative hazard) back to the TRI facility from which the release is occurring. Hence, that entire relative hazard value associated with that facility is included in the score for the county where the facility is located, although a part of the hazard may actually occur outside that county.

Taken together, NATA and RSEI provide a more complete picture of potential air toxic risk than either model alone since NATA focuses on the 33 air toxics considered by EPA to account for most of the inhalation risk from HAPs in most urban areas while RSEI addresses the much larger list of TRI emissions from fixed facilities that can be located in rural as well as urban areas. This distinction is illustrated by the NATA maps which show Atlanta as a significant problem area (largely from vehicle traffic), while the RSEI maps show Atlanta as having relatively little risk from industrial sources.

Disease and Mortality

A variety of studies have identified air pollution as risk factor for cancer, respiratory, and cardiovascular ailments. For this analysis, the Workgroup selected total respiratory and cardiovascular mortality, and total cancer morbidity at the county level, as disease incidence surrogates for air toxics impacts. Reliable morbidity estimates at the county level for respiratory and cardiovascular disease were not available, including asthma rates, and were not included in this analysis. NOTE: Inclusion of disease prevalence and death rates among the weighting criteria recognizes that cancer, respiratory, and cardiovascular disease may result from air toxics exposures or a number of other risk factors (e.g., smoking, diet, etc.). Given that our understanding of the action of air toxics on biological systems is incomplete, the Workgroup was compelled to use a weighting for this category that is much lower than that of the NATA modeled risk and RSEI relative hazard values (only 5% for each of the disease prevalence indicators).

The source for average annual age-adjusted respiratory and cardiovascular mortality rates was the CDC National Center for Health Statistics[4] data for the years 1994 to 1998, ICD9 (*International Classification of Diseases 9th Revision*[5]) Codes 490-519 and ICD9 Codes 390-459, respectively. Mortality rates are based on information from death certificates filed in each of the 50 States and the District of Columbia. The county rates used in this analysis are age adjusted to the US Census 2000 standard population[6], in order to avoid misleading information that could result from providing uncorrected data from counties whose population age structure is dominated by elderly or young citizens.

Total age-adjusted cancer morbidity rates were obtained from individual state cancer registries for all new cancer cases for the years listed below[7]. The rates are age adjusted to the 1970 US Census Standard Population, rather than the 2000 standard, since not all cancer registries have moved to the 2000 standard population structure. (Breast cancer rates include both in situ and invasive cases.) The following years' data were used for each state:

- Alabama ‘96-‘98
- Florida ‘95
- Georgia ‘95
- Kentucky ‘94-‘98
- Mississippi ‘96
- North Carolina ‘95-‘99
- South Carolina ‘96-‘98
- Tennessee ‘96

Population

The impact of air toxics on human health depends on there being a completed exposure pathway. As noted above, a particular interest in this analysis was to help identify relatively large populations with relatively large air toxics risks. To that end, the Workgroup selected population density (i.e., number of people per square mile) to represent population and included separate indicator elements for total population, the young (less than 18 years), and the elderly (65 and older), in order to recognize the sensitivity of the young and old to many air pollutants. Population data were obtained from the 2000 US Census[8] and were converted to population density by county.

Tallying the Results

There are 736 counties in Region 4. The results for each element for each county were weighted as described in Table 1 and summed for each county. The counties were then ranked from highest to lowest based on their summed indicators (see *Table 2. Region 4 Air Toxics Relative Risk Screening Analysis Matrix*, the matrix). The variables in the matrix are defined in Table 3 below. Graphic depictions of the data in the matrix are attached for the items identified in Table 3 with asterisks.

Table 3. Definition of Column Headers in the
Region 4 Air Toxics Relative Risk Screening Analysis Matrix

Name	County name
State_Name	Self explanatory
Area	Number of square miles in the county according to Environmental Systems Research Institute 1999 Data & Maps[9]
Age_U18	Number of people under 18 years of age living in the county according to the 2000 Census
Age65OVR	Number of people age 65 and over living in the county according to the 2000 Census
TOT2000	Total population in the county according to the 2000 Census

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RESPAAR *	Total respiratory mortality per 100,000 people according to ICD-9-CM Codes 490 - 519 which include:		
	490-496	Chronic Obstructive Pulmonary Disease and Allied Conditions	
		490	Bronchitis
		491	Chronic Bronchitis
		492	Emphysema
		493	Asthma
		494	Bronchiectasis
		495	Extrinsic allergic alveolitis
		496	Chronic airway obstruction, not elsewhere classified
	500-508	Pneumoconioses and Other Lung Diseases Due to External Agents	
		500	Coal workers pneumoconiosis
		501	Asbestosis
		502	Pneumoconiosis due to other silica or silicates
		503	Pneumoconiosis due to other inorganic dust
		504	Pneumonopathy due to inhalation of other dust
		505	Pneumoconiosis, unspecified
		506	Respiratory conditions due to chemical fumes and vapors
		507	Pneumonitis due to solids and liquids
		508	Respiratory conditions due to other and unspecified external agents
	510-519	Other Diseases of Respiratory System	
		510	Empyema
		511	Pleurisy
		512	Pneumothorax
		513	Abscess of lung and mediastinum
		514	Pulmonary congestion and hypostasis
		515	Postinflammatory pulmonary fibrosis
		516	Other alveolar and parietoalveolar pneumonopathy
		517	Lung involvement in conditions classified elsewhere
		518	Other diseases of the lung

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CARDAAR *	Total cardiovascular mortality per 100,000 people according to ICD-9-CM codes 390-459 which include: 390-392 Acute rheumatic fever 390 Rheumatic fever without mention of heart involvement 391 Rheumatic fever with heart involvement 392 Rheumatic chorea 393-398 Chronic Rheumatic Heart Disease 393 Chronic rheumatic pericarditis 394 Diseases of the mitral valve 395 Diseases of aortic valve 396 Diseases of mitral and aortic valves 397 Diseases of other endocardial structures 398 Other rheumatic heart diseases 401-405 Hypertensive disease 401 Essential hypertension 402 Hypertensive heart disease 403 Hypertensive renal disease 404 Hypertensive heart and renal disease 405 Secondary hypertension 410-414 Ischemic heart dsease 410 Acute myocardial infarction 411 Other acute and subacute forms of ischemic heart disease 412 Old myocardial infarction 413 Angina pectoris 414 Other forms of chronic ischemic heart disease 415-417 Diseases of pulmonary circulation 415 Acute pulmonary heart disease 416 Chronic pulmonary heart disease 417 Other diseases of pulmonary circulation 420-429 Other forms of heart disease 420 Acute pericarditis 421 Acute and subacute endocarditis 422 Acute myocarditis 423 Other diseases of pericardium 424 Other diseases of endocardium 425 Cardiomyopathy 426 Conduction disorders

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			428	Heart failure
			429	Ill-defined descriptions and complications of heart disease
	430-438	Cerebrovascular disease		
			430	Subarachnoid hemorrhage
			431	Intracerebral hemorrhage
			432	Other and unspecified intracranial hemorrhage
			433	Occlusion and stenosis of precerebral arteries
			434	Occlusion of cerebral arteries
			435	Transient cerebral ischemia
			436	Acute, but ill-defined cerebrovascular disease
			437	Other and ill-defined cerebrovascular disease
			438	Late effects of cerebrovascular disease
	440-448	Diseases of arteries, arterioles, and capillaries		
			440	Atherosclerosis
			441	Aortic aneurysm
			442	Other aneurysm
			443	Other peripheral vascular disease
			444	Arterial embolism and thrombosis
			446	Polyarteritis nodosa and allied conditions
			447	Other disorders of arteries and arterioles
			448	Disease of capillaries
	451-459	Diseases of veins and lymphatics, and other diseases of circulatory system		
			451	Phlebitis
			452	Portal vein thrombosis
			453	Other venous embolism and thrombosis
			454	Varicose veins of lower extremities
			455	Hemorrhoids
			456	Varicose veins of other sites
			457	Noninfectious disorders of lymphatic channels
			458	Hypotension
			459	Other disorders of circulatory system

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NATANCNR *	NATA-estimated average individual noncancer hazard value for the county
NATADESL *	NATA-estimated average diesel concentration for the county in ug/m^3
NATACNCR *	NATA-estimated average individual cancer risk for the county
CNCRAAR *	Total age adjusted incidence of cancer per 100,000 people according to state cancer registries
PDNS65O *	Density of population aged 65 and over in the county
PDNSTU18 *	Density of population under 18 in the county
PDNSTTOT *	Density of total population in the county
SUM_HAXSCO *	RSEI relative hazard ranking for the county. This equals the pounds of chemical releases to the air reported to EPA by facilities in the county, multiplied by the toxicity of each chemical, and summed
W3NATAD	The weighted diesel score for the county. This equals the county's average diesel value (NATADESL) from the NATA divided by the highest average diesel value among Region 4 counties (2.394) and multiplied by the NATA diesel concentration weight (5%)
W3NATAC	The weighted NATA individual cancer risk score for the county. This equals the county's average individual cancer risk estimate according to NATA (NATACNCR) divided by the highest average individual cancer risk estimate among Region 4 counties (0.000107) and multiplied by the NATA cancer risk weight (10%)
W3NATAN	The weighted NATA noncancer hazard score for the county. This equals the county's average individual noncancer hazard value (NATANCNR) divided by the highest average individual noncancer hazard value among Region 4 counties (13.48) and multiplied by the NATA noncancer weight (10%)
W3TRI	The weighted RSEI relative hazard score for the county. This equals the county's RSEI relative hazard ranking value (SUM_HAXSCO) divided by the highest RSEI relative hazard ranking value among Region 4 counties (10,935,714,208.5) and multiplied by the RSEI hazard ranking weight (25%)
W3RESP	The weighted respiratory mortality score for the county. This equals the county's respiratory mortality value (RESPAAR) divided by the highest respiratory mortality value among Region 4 counties (128.3) and multiplied by the respiratory mortality weight (5%)

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W3CARD	The weighted cardiovascular mortality score for the county. This equals the county's cardiovascular mortality value (CARDAAR) divided by the highest cardiovascular mortality value among all Region 4 counties (700.5) and multiplied by the cardiovascular mortality weight (5%)
W3CANCR	The weighted incidence of cancer score for the county. This equals the county's total cancer incidence value (CNCRAAR) divided by the highest cancer incidence among the Region 4 counties (722) and multiplied by the cancer incidence weight (5%)
W3PDTOT	The weighted total population density score for the county. This equals the county's total population density (PDNSTTOT) divided by the greatest population density among the Region 4 counties (2946) and multiplied by the total population density weighting factor (15%)
W3PDU18	The weighted population density score of people under age 18 in the county. This equals the county's population density of people under 18 (PDNSTU18) divided by the greatest population density of people under age 18 among the Region 4 counties (637) and multiplied by the weighting factor for population density of people under age 18 (10%)
W3PD65O	The weighted population density score of people aged 65 and older in the county. This equals the county's population density of people aged 65 and older (PDNS65O) divided by the greatest population density of people aged 65 and older among the Region 4 counties (674) and multiplied by the weighting factor for population density of people aged 65 and older (10%)
W3SUM *	The final matrix value for the county. This is the sum of each of the weighted values listed above, (i.e.,W3NATAN, W3NATAC, W3NATAD, W3TRI, W3RESP, W3CARD, W3CANCR, W3PDTOT , W3PDU18, W3PD65O). This is the value that is the basis for the final matrix map.

ANCILLARY (NON-QUANTIFIED) DATA

Nonattainment Status

EPA has a rigorous regulatory program to assess and address the impacts of six "criteria" pollutants (ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, and particulate matter) and has established national ambient air quality standards (NAAQS) for these pollutants. For purposes of this analysis, the Workgroup chose to include additional maps related to two of these criteria pollutants since high levels of these pollutants may be indicative of a related air toxics problem (e.g., ozone is formed by the combination of nitrogen oxides and volatile organic compounds, many of which are hazardous air pollutants). Specifically, maps are included that indicate counties which are not meeting the ambient air quality standards for ozone and particulate matter.

The first map shows areas currently violating and/or designated non-attainment for the 1-hour ozone standard based on preliminary 2000-2002 data. These are the most recent preliminary data available and are subject to revision following quality assurance reviews. The second map indicates counties that are violating the 8-hour ozone standard, the PM 2.5 standard, or both, based on 1999-2001 data. EPA expects to designate areas for the 8-hour ozone standard and the PM-2.5 standard in 2004. These designations will be based on the most recent three year period of quality assured data available at the time of the designations.

Air Stagnation

Air stagnation results from particular meteorological conditions that persist over an extended period of time. Such events may result in higher than normal exposures to people living in the stagnation area. Scientists have developed a number of methods to identify areas where stagnation may generally be expected to occur and the results of two of these approaches have been included in this analysis. The National Oceanic and Atmospheric Administration (NOAA) reviewed climatological information for 1948 through 1998 to identify areas that met certain criteria [10]. The general criteria used to identify stagnant conditions were upper air winds extrapolated to surface level geostrophic (frictionless) wind speeds less than 4m/s, no precipitation at all, and these conditions lasting for at least 4 consecutive days. If these conditions were met, the total number of stagnation days were tallied and plotted in the map. In the Southeast, most stagnation events occur in the May through October period. During this time, most of the events occur in August and September, peaking at about 6 events per month. May, June, and July follow with about 4 events per month. From this analysis, stagnation is generally expected to increase as one moves towards the southern central to southwest portion of Region 4.

The second map, developed at EPA in the 1970's, evaluated the meteorological potential for urban air pollution [11]. The author defined an episode of limited dispersion as existing when, for a period of at least 2 days, the mixing height is 1500 m or less, wind speeds are 4 m/s or less, and there is no significant precipitation during the 12 hours covering each mixing height calculation. This second map is based on actual surface meteorologic data and therefore is influenced by local terrain. For this reason, it presents a somewhat different picture than the NOAA map, showing the greatest potential for stagnation in the southeast to be in the tri-state area of Kentucky, Ohio, and West Virginia.

Analysis

The detail in the matrix allows us to begin to look at the potential causes of air toxics issues in a given county. The numerical results in the Matrix are portrayed in the *Region 4 Air Toxics Relative Risk Screening Analysis* map. *Table 4, U.S. EPA Region 4 Air Toxics Relative Risk Screening Analysis - Contributors to Highest Ranking County Scores,* indicates for the 10 highest ranked counties Region wide (and for the highest ranked county in the state if none from that state was included among the 10 highest ranked Region wide - i.e., Jefferson, AL; Mecklenburg, NC; Shelby, TN; Grenada, MS; Richland, SC), which elements were the most important contributors to the county's total weighted score.

The base data for the table are taken from the matrix as noted by the variable names. Those components that contributed approximately 15% or more of the county's total score are indicated in bold. A first look at the results indicates that:

- population density is a significant contributor to the total score in 7 of the 10 highest ranked counties
- neither morbidity nor mortality is a significant contributor to the total score in any of the 10 highest ranked counties
- among the 14 counties listed, NATA values were significant contributors in 8, and RSEI values in 7; usually in those counties where NATA data were significant, RSEI were not, and vice-versa.

NATA-Dominated Scores

Table 5, NATA Cancer and non Cancer Average Individual Risk Estimates from Inhalation of Selected Air Pollutants, takes a closer look at the NATA values for each county. The data in this table were taken from the NATA website[1]. The table details the contribution of "major sources," "area sources," and "onroad and nonroad mobile sources" to the NATA cancer and noncancer hazard index values.

The average cancer risk and the average hazard index in the table each include the contribution from background levels of airborne pollutants. Background concentrations are those that could have been found in 1996 even if there had been no recent manmade emissions. Background air toxics concentrations are from natural sources, resuspension of prior years' emissions, and long range transport from distant sources. Background concentrations are based on values identified in EPA's Cumulative Exposure Project[12] which estimated 1990 ambient concentrations of air toxics. That study identified background concentrations of hazardous air pollutants at "clean air locations" that were remote from the impact of local anthropogenic sources. These concentrations were found in published journal articles, reports, and books. Background concentrations were assumed to be constant across the nation since the available data were insufficient to address geographic variations. NATA used the background values from the Cumulative Exposure Project for 13 air toxic pollutants. For the remaining chemicals, NATA assumed a value of zero. For diesel concentrations, a modeling based approach was used to estimate the approximate concentrations due to transport from sources between 50 and 300 kilometers away. Hence diesel background concentration estimates will vary across the country.

The average cancer risk from background levels of air toxics is approximately 2.0E-5. In the case of Muhlenberg County, this accounts for most of the inhalation cancer risk from airborne NATA pollutants, but in most other counties, it accounts for about 20% to 50% of the air toxics inhalation cancer risk. The average noncancer hazard index value due to background levels of airborne NATA pollutants is about 0.025, accounting for between 0.2% and 2% of the total NATA air toxics hazard index.

A close look at Table 5 indicates that for most of the counties considered here, mobile sources are the greatest anthropogenic contributor to the NATA air toxics risk estimates, and onroad sources typically dominate the mobile source contribution. For some counties, area sources are significant contributors to the risk estimates, and generally, "major sources" are minor contributors to the NATA risk estimates. This cursory analysis of the data suggests that the risk management plans for many counties will require an assessment of motor vehicle use.

RSEI-Dominated Scores

The RSEI indicator element is a major contributor to the total score for some counties in Table 4. RSEI reflects the TRI reported emissions of hundreds of chemicals from fixed facilities, rather than the 33 most significant urban air toxics that NATA considers. For those counties for which the stationary source emissions are significant contributors to their air toxics concentrations, detailed information is available on the individual sources and the chemicals they emit, by visiting the TRI website[13]. Using this information, and the RSEI software[2], the local government, industry, and stakeholders in the community can evaluate which emissions pose the greatest threat to the population, and devise a plan that addresses the greatest risks in the most cost effective way possible. Many industrial facilities are regulated by MACT rules, and their emissions may be further limited by residual MACT rules in the future.

It is important to note, however that the RSEI analysis only considers the information provided by facilities reporting their releases under the TRI program. Only facilities that meet particular criteria are required to report. Hence, risk managers should also consider whether there are other significant sources that may be contributing to the air toxics concentrations, but which may not be reporting under TRI.

Conclusion

The purpose of this screening analysis is to help focus our efforts and those of our state and local air program partners in assessing and addressing air toxics risks throughout the Southeast. The information developed through such a screening process should, however, be "truthed" and considered in light of other relevant information. Because of the limitations of the NATA results, they should not be used to determine source specific contributions to air toxics concentrations or risks. Likewise, TRI data are available only after a lag period from the time the reports were submitted, and even then, will not include emissions from all sources due to reporting requirements. Since some of the data used here are several years old, it is important to visit the locations identified as potential problem areas and investigate whether the sources still exist and whether they have already reduced their emissions. It is likewise important to recognize that there may be more vehicle miles traveled today than when the data were collected, an important consideration particularly in urban areas.

It is also essential to understand that air toxics have indoor as well as outdoor sources. Concentrations of many airborne chemicals are typically 2-5 times higher indoors than they are outdoors, with some being even higher. When we also consider that exposure periods indoors greatly exceed our time spent outdoors, it is clear that a comprehensive approach to air toxics risk management should address both indoor and outdoor environments.

Once specific areas have been identified for more detailed study, modeling, monitoring, and the collection of additional information on local air toxics risks may ensue. Ultimately, the information collected should serve as a guide for air toxics programs as they establish their priorities for reducing risks from air toxics in the community. These efforts could include a blend of regulatory and voluntary activities and should involve informed risk management decisions made with the involvement of industry, the public, and government officials. As local air toxics risk management plans are developed and implemented, their effectiveness should be evaluated periodically. It is reasonable to expect both successes and the need for mid-course corrections as the plan is carried out. Through reevaluations the plan will be refined and new situations addressed as the community manages its risk from air toxics.

References

1. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *National-Scale Air Toxics Assessment 1996 Results*. Available at http://www.epa.gov/ttn/atw/nata and personal communication with Ted Palma, USEPA Office of Research and Development.
2. U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, *Risk Screening Environmental Indicators - Version 2.0 Beta Software*. Available at http://www.epa.gov/opptintr/env_ind/index.html; and personal communication with Richard Engler and Steven Hassur, USEPA Office of Pollution Prevention & Toxics, Economics, Exposure, and Technology Division.
3. U.S. Environmental Protection Agency, National Center for Environmental Assessment, *Health Assessment Document for Diesel Engine Exhaust*. Available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29060, May, 2002.
4. U.S. Department of Health and Human Services, Centers for Disease Control, National Center for Health Statistics at http://www.cdc.gov/nchs/
5. U.S. Department of Health and Human Services, *The International Classification of Diseases 9th Revision Clinical Modification, ICD 9 CM, Third Edition Volume 1, Diseases Tabular List*. DHHS Publication PHS 89-1260, 1989. (ICD-9, published by the World Health Organization for the classification of morbidity and mortality information for statistical purposes, is out of print; ICD-9-CM is totally compatible with its parent system ICD-9, and provides more morbidity detail. In 1999, ICD-10 began to be used to categorize morbidity and mortality data.)
6. U.S. Department of Health and Human Services, Centers for Disease Control, National Center for Health Statistics, *Year 2000 Population Standard for Age-Adjusting Death Rates in the United States*, available at http://www.cdc.gov/nchs/data/IW134Pfct.pdf
7. Information obtained from state cancer registry websites or representatives:

Alabama	http://www.adph.org/cancer_registry/all%20cancer%20sites_inc.pdf
Florida	www.fcds.med.miami.edu
Georgia	http://health.state.ga.us/programs/cancer/index.shtml
Mississippi	www.msdh.state.ms.us
Kentucky	Source of information: tct@kcr.uky.edu
Tennessee	Source of information: tbounds@mail.state.tn.us
South Carolina	Source of Information: sanderlc@columb20.dhec.state.sc.us
North Carolina	Source of Information: deirdre.rogers@ncmail.net

8. United States Department of Commerce, U.S. Census Bureau, *United States Census 2000*, available at http://www.census.gov/
9. *ESRI Data & Maps*, Environmental Systems Research Institute Incorporated, 1999
10. Wang, J.X.L. and J.K. Angell, *Air Stagnation Climatology for the United States (1948-1998)*, National Oceanic and Atmospheric Administration/Air Resources Laboratory Atlas No. 1, 73 pp., 1999, and personal communication with the author.
11. Holzworth, G.C., “Meteorological Potential for Urban Air Pollution in the Contiguous United States,” Paper No. ME-20C presented at the Second International Clean Air Congress,

Washington, D.C., December 6-11, 1970.
12. U.S. EPA Cumulative Exposure Project available at: http://www.epa.gov/oppecumm/air/air.htm
13. U.S. EPA TRI Explorer available at http://www.epa.gov/triexplorer/reports.htm